

Evaluation of Two Control Methods for Reducing Damage from Sequoia Pitch Moth, Big Fork Tree Improvement Area, Flathead National Forest, Montana

Nancy Sturdevant, Sandy Kegley, Bill Crane and Chris Hayes

USDA Forest Service, Northern Region, Forest Health Protection

Sequoia pitch moth, *Synanthedon sequoiae* (SPM), attacks primarily lodgepole and ponderosa pine trees growing in seed orchards, tree improvement areas, and natural forest settings. SPM incidence and damage is usually higher at genetic test sites than in natural forest settings because trees in genetic tests are from a variety of locations growing off-site, which can stress and predispose them to insect and disease problems. Attacks from SPM can weaken trees and cause branch break-offs.

SPM has a two-year life cycle in Montana and Idaho. Larvae bore in phloem and outer layers of wood causing masses of pitch to form on boles and branches of trees (figure 1). After larvae complete their development, pupae form with the pupal cases protruding from the mass (figure 1). In Montana, adult moths fly from June through early August and lay eggs on boles of trees, usually in bark crevices.

Control efforts for SPM in the past have been accomplished primarily by manually removing pitch masses from individual trees, usually 2-3 times per year and destroying larvae found. This is very labor intensive and is only partially effective because of not finding all pitch masses or larvae inside of pitch masses. Recently, mating disruption trials were attempted for SPM (Strong 2002) that did not result in reducing impacts from SPM. Strong (2002) suggests that their lack of success may have been due to differing levels of SPM prior to the mating disruption





Figure 1. Sequoia pitch moth larva in pitch mass (left) and pupal case sticking out of pitch mass (right).

trials, immigration of moths from surrounding areas, small plot size, or an incomplete pheromone blend.

Recently, several studies have suggested that a SPM synthetic lure may be effective at trapping out moths from areas such as seed orchards and backyard settings (Darek Czokajlo, Ph.D., Alpha Scents, personal communication). Traps and pheromone lures are available commercially for this purpose (Advanced Pheromone Technologies) with limited supporting data. If an effective mass trapping control technique could be developed for SPM, it would require less money and time and possibly be more effective when compared to the current method of control of removing pitch masses and larvae manually.

Another potential control method is to create a physical barrier with tree wrap to prevent second-year pupae emerging from trees and attacking new host trees and to prevent moths from laying eggs or larvae boring into the bole. This method has been tried in a few seed orchards in British Columbia with fewer attacks on wrapped trees over a 2-year period (Jim Corrigan, personal communication). However, no reports have been completed summarizing their results to date.

The objective of this study was to evaluate two different methods to reduce damage from SPM at the Bigfork Tree Improvement area: mass-trapping and creating a physical barrier.

Methods

The lodgepole pine at Bigfork is planted in approximately 2 acre blocks within the tree improvement area. Each lodgepole pine block is located about $\frac{1}{4}$ to $\frac{1}{2}$ miles apart from each other. The block located farthest south served as a control block; the block in the center was used to evaluate the tree wrap; and the block farthest north was used for evaluating mass trapping (see map in appendix). All three blocks contained 175 or 178 lodgepole pine trees of similar size.

On April 29, 2014 prior to treatment, we evaluated 50 trees (every 4th tree) in each treatment and control block for number of pitch masses. We recorded 167 pitch masses in the control block and 159 in the mass trapping block; these totals were not significantly different. We also recorded 102 pitch masses in the tree wrapping block.

On May 15, four pheromone-baited (Alpha-Scents, Inc. SPM lures) Delta traps (figure 2) were hung in lodgepole pine trees located at each corner of each block to determine the beginning of SPM flight period for 2014.



Figure 2. Sequoia pitch moth pheromone trap.

Mass Trapping

On June 11, after catching moths in monitoring traps, one-hundred large pheromone baited Delta traps were placed in the orchard on approximately every other tree in the block (50 per acre) except for in rows along the perimeter of all four sides. Traps were checked weekly for moths (figure 3) through September and number of moths found was recorded. Pheromone baits were replaced mid-season on July 21. Traps were checked at the end of August and number of moths found was recorded. After moth flight in September, we examined 50 trees (every 4th tree) in the mass trapping and control blocks for new pitch mass attacks.



Figure 3. Sequoia pitch moth caught in pheromone trap.

Tree Wrapping

On May 15, 2014, 90 trees were randomly selected for treatment trees in the tree wrapping block. Each of the 90 trees was wrapped with tree wrap (Tangle Guard Banding material, Contech Inc.) up to approximately 4.5 feet in height on the bole (figure 4). Tanglefoot (Tanglefoot Insect Barrier, Contech Inc.) was applied to all branch crevices and gaps in tree wrap. Diameter at d.b.h was collected for all treatment and control trees. An additional five trees were treated with only Tanglefoot. Tanglefoot was applied up to 4.5 feet in height on the bole and around the base of all branches. Only five trees were treated with Tanglefoot because it was quickly determined that this potential control method required too much time and would be too costly. After moth flight in September, we evaluated all treatment and 90 control trees for number of new pitch masses. Control trees were located in the same lodgepole pine block and were of similar diameter as treatment trees ($df = 175$, $t = 0.29$, $P = 0.77$; C mean \pm SEM = 5.0 ± 0.5 in. d.b.h, W mean \pm SEM = 4.9 ± 0.5 in. d.b.h). Trees ranged from 1.42 to 8.2 inches d.b.h, with a majority of trees 5 to 6 inches d.b.h



Figure 4. Tree wrap on Lodgepole pine as a physical barrier to prevent attack by sequoia pitch moths.

Results

Mass Trapping

A total of 71 moths were caught in all of the pheromone traps during the SPM flight period in the mass-trapping block. A total of 224 new pitch masses were found in the treatment block and 240 new pitch masses were found in the control block. Based on these numbers we did not expect significant differences in number of pitch masses between treatment and control blocks and therefore did not test for significance. SPM has a two-year life cycle and the final results from this trial will not be available until following moth flight next fall. However, based on other trials and the results from our first year's trial, we are planning on repeating the study but reducing the number of pheromone-baited funnel traps to 12 per acre. Growers in California working with chemists from Alpha-Scents have reported good mass trapping results for SPM in a trial using 12 traps per acre.

Tree Wrapping

Significantly fewer (41%) wrapped trees were attacked by SPM than control trees (72%) (Chi-sq = 17.6, $P < 0.0001$). Because pitch masses per tree data violated the normality assumption, the

Wilcoxon Rank Sums test was used to compare means in this case. Significantly fewer pitch masses per tree were found on the treatment trees than the control trees ($Z = 4.9$, $P < 0.0001$) (figure 5). Individual treatment trees had an average of 0.8 ± 0.1 (Mean \pm SE) pitch masses per tree versus control trees which had an average of 2.1 ± 0.2 (Mean \pm SE) pitch masses per tree.

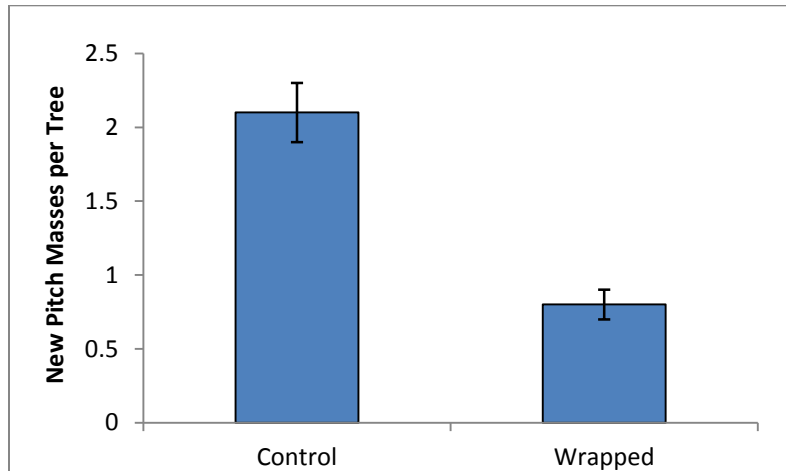


Figure 5. Number of new SPM pitch masses per tree found in September, 2014 on lodgepole pine study trees at Bigfork Tree Improvement area. Bars equal mean \pm SEM.

Following the heavy rains in the spring and early summer of 2014, some of the tree wrap slipped from the bole exposing small spots of bark. New SPM attacks were commonly found in or near where the wrap had slipped (figure 6).

There are two types of protection that the tree wrap may provide. One is where the tree wrap directly protected or prevented oviposition on the boles of trees by adult moths. The second, or indirect control mechanism, is the wrap may have prevented SPM pupae from emerging and may have an effect on population levels next year.

Conclusions

The results of this study suggest that tree wrapping may reduce damage from SPM. Although final results will not be available until fall 2016 following completion of the SPM's 2-year life cycle. Also, we may have seen even fewer attacks by SPM if a different and more flexible tree wrap was used resulting in less wrap slippage. In order for the control method to be cost-



Figure 6. Sequoia pitch moth mass where tree wrap slipped on tree bole.

effective, the tree wrap needs to remain intact for at least several years. We are planning on re-applying tree wrap to all of the treatment trees in 2015 using a new more stretchy and durable wrapping material. The wrap will be applied in late May or early June prior to SPM flight. In the fall, we will evaluate number of trees attacked and total number of pitch masses on treatment and control trees.

Mass trapping results were disappointing, as we caught far fewer moths than we had expected. Several scientists and chemists from pheromone-producing companies suggested that the low trap catches seen in this study may have been due to pheromone disruption caused by high trap density. Next year we plan on mass trapping in these blocks at lower trap densities. Pre-trapping data were collected last fall (number of new pitch masses in control and mass trapping blocks).

References

Jim Corrigan, personal communication. 2015. Interior Seed & Cone Pest Management Biologist, Kalamalka Seed Orchards, Tree Improvement Branch, B.C. Ministry of Forests, Lands and Natural Resource Operations.

Darek Czokajlo, Ph.D., personal communication. 2015. Alpha Scents, Director.

Strong, W. 2002. Sequoia Pitch Moth Mating Disruption. *In*: Forest Genetics Council of BC Tree Improvement Program, Project Report. Compiled by Brian Crown and Roger Painter, Tree Improvement Branch of the BC Ministry of Forests. pp 30-32.

Acknowledgement

We would like to thank Austin Lowe for his enthusiasm, assistance and support throughout this project.

Appendix

Map of treatment blocks at Big Fork Tree Improvement Area (LPP treatment blocks in red).

Bigfork Tree Improvement Area (BFTIA)
 Swan Lake Ranger District, Flathead National Forest
 Flathead County, Montana

Latitude: 48° 07' 25", Longitude: 117° 07' 25" (Approximate) 1927 North American Datum
 T. 27 N., R. 19 W., SE1/4 of the SE 1/4 of Sec. 11, and NE 1/4 of Sec. 14, P.M.M.

NORTH
 ↑
 SOUTH

